Appendix N. Environmental Noise Analysis/Caltrans Protocol Technical Analysis SR 28 Kings Beach Corridor Improvement

Environmental Noise Assessment/Caltrans Protocol Technical Analysis

SR 28 Kings Beach Corridor Improvement

Placer County/Lake Tahoe, California

Project # 2006-098

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Chapter 3.9 Noise

3.9.1 Regulatory Setting

Purpose and Need:

This Environmental Noise Analysis will focus on the change in traffic noise levels, and noise levels due to construction activities associated with the S.R. 28 corridor roadway improvements. For the purposes of this analysis the Existing and Future Year 2028 noise environments have been evaluated for each of the alternatives. Predicted noise levels are compared to the applicable Caltrans/Federal Highway Administration (FHWA) TRPA noise level criteria. This analysis has been prepared in accordance with the guidelines of the Caltrans Traffic Noise Analysis Protocol and CFR 772 which is incorporated by reference into the Traffic Noise Analysis Protocol, and the TRPA guidelines.

Background

Placer County and the TRPA are evaluating alternative corridor improvements along S.R. 28 through Kings Beach, as a means of improving traffic flow, reducing conflicts between on-street parking and traffic, while being mindful of the TRPA environmental thresholds.

3.9.1.1 Study Methods and Procedures

Selection of Receivers

For the purposes of this analysis, twenty-four (24) receiver sites were selected for evaluating potential noise impacts. The receiver sites were selected to evaluate potential traffic noise impacts at all noise-sensitive receivers (Category B of the Protocol) within the area of potential affect. Figures 3.9-2A through 3.9-2E show the receiver locations.

Field Review and Noise Measurement Procedures

A detailed site review was conducted in November 2004. Continuous 24-hour noise measurement data previously collected along the project site in August and October 2004 were utilized for this report. Noise measurements consisted of continuous hourly noise measurements at two locations for a period of 24-hours.

The continuous 24-hour noise level measurements were conducted at two locations to represent noise-sensitive land uses. The measurements were conducted to determine the relationship between the measured 24-hour CNEL traffic noise level and the peak hour Leq noise levels, and for comparison to the Sound 32 model. Figure 3.9-1 shows the locations of the noise measurement

sites. Appendices 3.9-B1 and 3.9-B2 graphically show the results of the continuous hourly noise level measurements.

Sound measurement equipment consisted of Larson Davis Laboratories (LDL) Model 820 precision integrating sound level meters. The measurement equipment was calibrated immediately before and after use, and meets the pertinent specifications of the American National Standards Institute (ANSI) and the International Electrotechnical Institute (IEC) for Type 1 precision sound measurement systems.

Noise Prediction Methodology

To describe existing and projected peak hour noise levels due to traffic, j.c. brennan & associates, Inc. used the Sound-32 traffic noise prediction model. The Sound 32 model was developed to predict hourly Leq values for free-flowing traffic conditions, and is considered to be accurate within 1.5 dB.

The Sound-32 Model is the Caltrans-coded version of the Federal Highway Administration's Stamina 2.0 and Optima traffic noise prediction programs. The current version of Sound-32 reports noise levels in Leq. The Sound-32 Model was used for comparison to the FHWA and Caltrans noise level criteria.

Traffic volumes that were used as direct inputs to the Sound-32 model were provided by the project traffic consultant. Speeds along the route were based upon observed travel speeds in the field, and truck mix percentages were based upon Caltrans truck count data for S.R. 28 and S.R. 267.

Based upon the noise measurement results, it can be expected that the 24-hour CNEL value due to traffic, is approximately 1 dB below the peak hour traffic noise levels.

3.9.1.2 Study of Project Alternatives

The following provides a detailed description of each of the alternatives:

Alternative 1: This alternative include one traffic lane in each direction, a center turn lane, one bike lane/parallel parking lane in each direction, sidewalks on each side, and roundabouts at coon Street, Bear Street, and S.R. 267.

Alternative 2: This alternative includes two traffic lanes in each direction, one bike lane/parallel parking lane in each direction, sidewalks on each side, and traffic signals at Coon Street, Bear Street, and S.R. 267. Left turn lanes are located at each signaled intersection plus at Fox Street.

Alternative 3: This is the Tahoe Regional Planning Agency (TRPA) recommended alternative, and is similar to Alternative 1. The primary difference

from a traffic standpoint is that no street parking is provided along either side of S.R. 28.

Alternative 4: This alternative includes 2 traffic lanes westbound, one traffic lane eastbound, a two-way left turn lane, on bike lane/parallel parking lane on the westbound side, one bike lane eastbound, sidewalks on each side, and roundabouts at Coon Street, Bear Street, and S.R. 267.

3.9.1.3 Criteria of Significance

The following criteria have been applied in this evaluation:

Traffic Noise Analysis Protocol

The criteria for evaluating noise impacts that are used by the FHWA and Caltrans are contained in the Caltrans Traffic Noise Analysis Protocol (The Protocol). Based upon The Protocol, the proposed project is considered a Type 1 project. The project has also been determined to pass the screening procedures for determining the need for a Traffic Noise Impact Analysis, and is therefore required to include a Traffic Noise Impact Analysis.

The Protocol establishes Noise Abatement Criteria (NAC) for various land uses which have been categorized based upon activity. Land uses in these documents are categorized on the basis of their sensitivity to noise. The Category B criterion applies to residences, hotels, motels, churches, schools, recreation areas, active sport areas, and parks, and is an hourly exterior sound level that approaches (within 1 dB) or exceeds the hourly NAC of 67 dBA, Leq. The Category C criterion applies to commercially developed land uses, and is an hourly exterior sound level that approaches or exceeds 72 dB Leq. The Category E criterion applies to residences, motels, hotels, schools, hospitals, and similar uses, and is an hourly interior sound level of 52 dB Leq. The interior sound level criterion only applies in those situations where there are no exterior activities to be affected by the traffic noise. The Protocol also goes on to state that a noise increase is considered substantial when the predicted noise levels with the project exceed existing noise levels by 12 dBA, Leq.

Under The Protocol, traffic noise abatement must be considered when the predicted noise levels "approach or exceed" the NAC or when the predicted noise levels substantially exceed existing noise levels and it is reasonable and feasible to provide noise attenuation. A minimum 5 dBA noise reduction must be achievable for a project to be considered feasible. However, feasibility may also be restricted by topography, access requirements, presence of local cross streets, other noise sources in the area and safety considerations.

Noise abatement reasonableness is stated within The Protocol as being more subjective in nature than the feasibility determination. The Protocol states that the

reasonableness of noise abatement considers the cost of the abatement, absolute noise levels, changes in noise levels, noise abatement benefits, development along the highway, life cycle of the proposed noise abatement, environmental impacts of the proposed noise abatement, opinions of impacted residents, input from the reviewing public agencies and the social, economic, environmental, legal and technological factors. The Protocol provides procedures for determining preliminary reasonableness for residential areas in Land Use Category B. This procedure will be described in this report if noise abatement is considered.

Technical Noise Supplement

The Technical Noise Supplement, also referred to as the "TENS", is the technical supplement to the Protocol. The intent of the TENS is to provide a detailed technical guidance in the Measurement and Instrumentation which may be used for the analysis, Traffic Noise Impact Screening, the Detailed Traffic Noise Impact Analysis, Barrier Design Considerations, Study Report preparation, Special Considerations which may need to be used when encountering complex situation.

The TENS is used throughout the preparation of this Technical Noise Analysis.

TRPA Regional Plan and Plan Area Statement Criteria

The TRPA has adopted Environmental Thresholds for the Lake Tahoe Region. The noise standards included in the overall noise threshold include numerical Community Noise Equivalent Level (CNEL) values for various land use categories and transportation corridors.

As a form of zoning, the TRPA has divided the Lake Tahoe Region into more than 175 separate Plan Areas. Boundaries for each Plan Area have been established based upon similar land uses and the unique character of each geographic area. For each Plan Area, a "Statement" is made as to how that particular area should be regulated to achieve regional environmental and land uses objectives. As part of each "Statement" an outdoor Community Noise Equivalent Level (CNEL) standard is established based upon the "Thresholds." The project corridor is located within Plan Areas 029 (Kings Beach Commercial). The Plan Area also provides for a noise level criterion of 60 dB CNEL for the S.R. 28

The CNEL standards have also been established for major highways such as the S.R. 28 corridor. The roadway corridor CNEL standards generally override the Plan Area standards at a distance of 300 feet from the edge of the roadway. The CNEL standard for the S.R. 28 corridor is 55 dB CNEL. However, the Plan Area Statement noise level criterion is the ultimate standard.

Figure 3.9-1
SR 28 Improvemnent Corridor
Kings Beach, CA

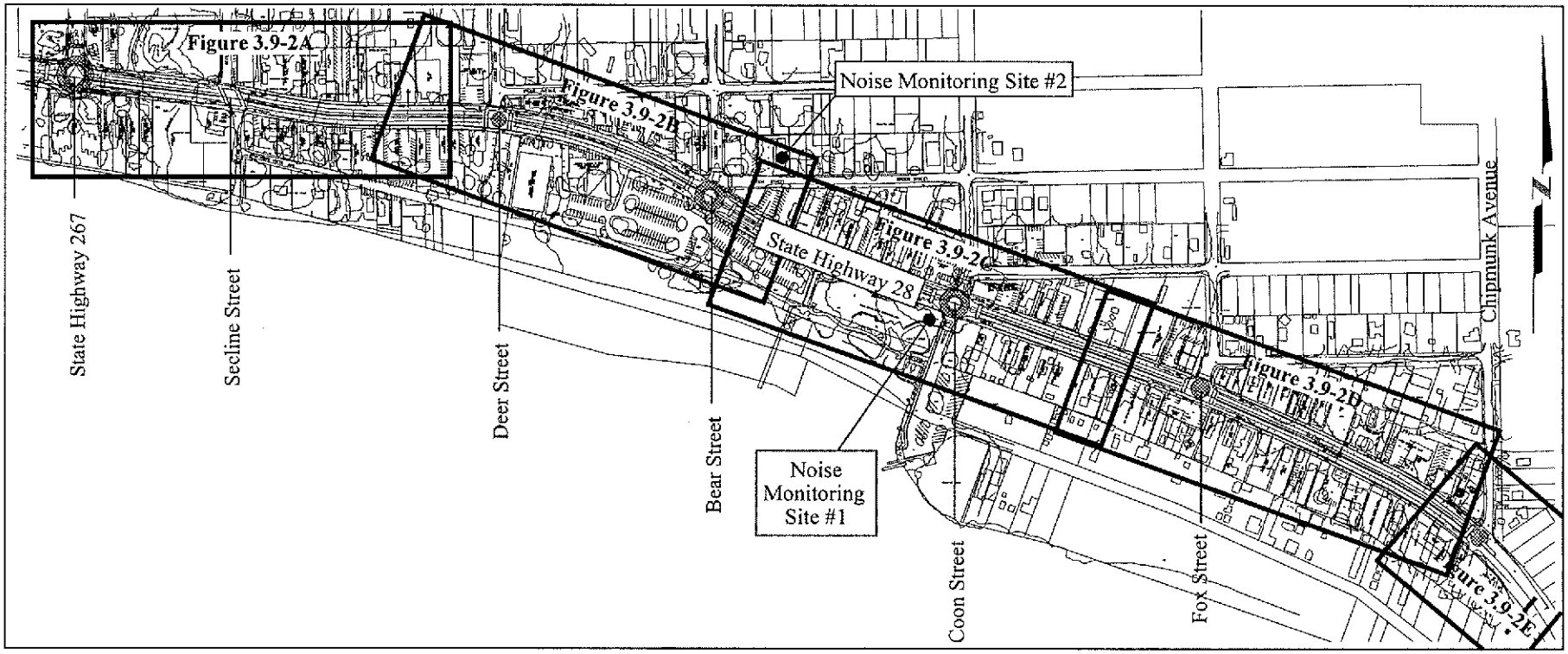

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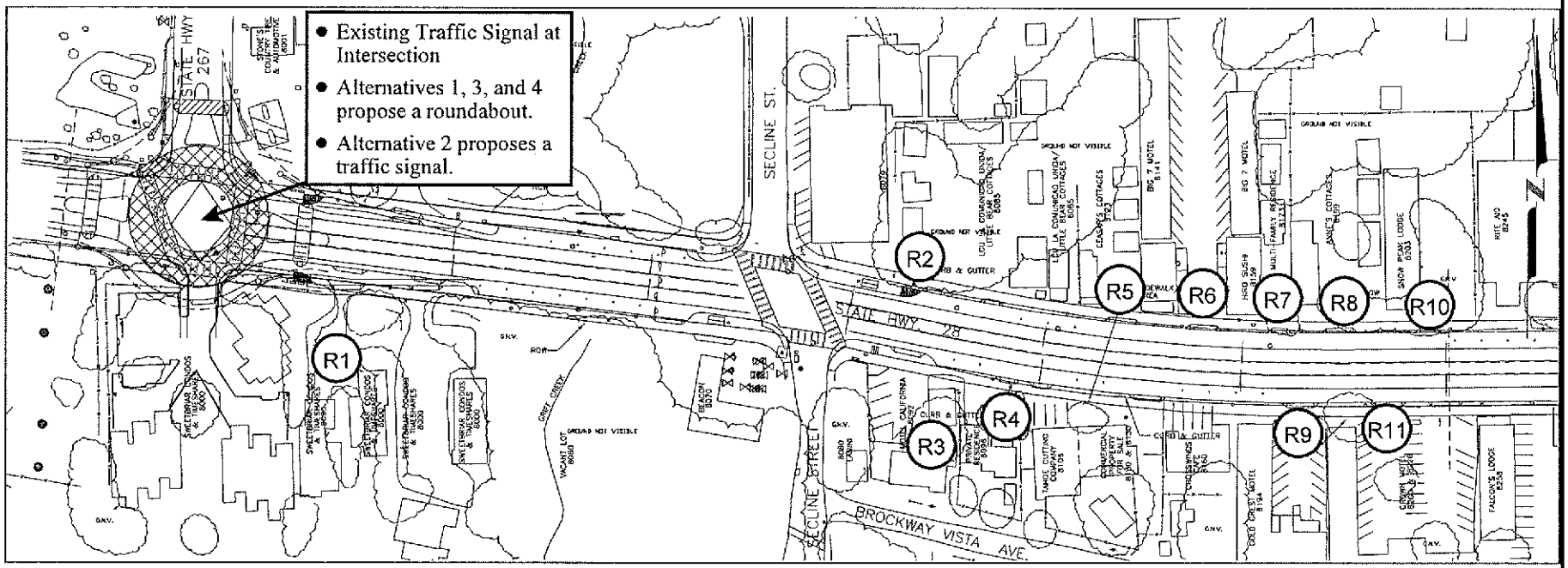
Figure 3.9-2A
Modeled Receiver Locations



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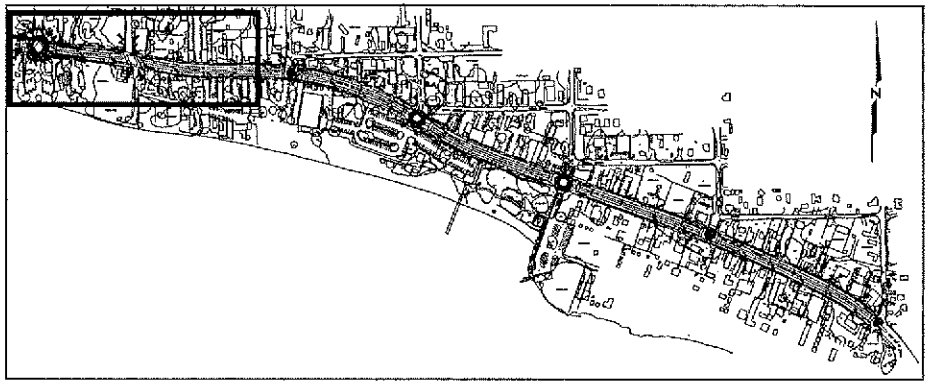

(R#) : Modeled Receiver Locations

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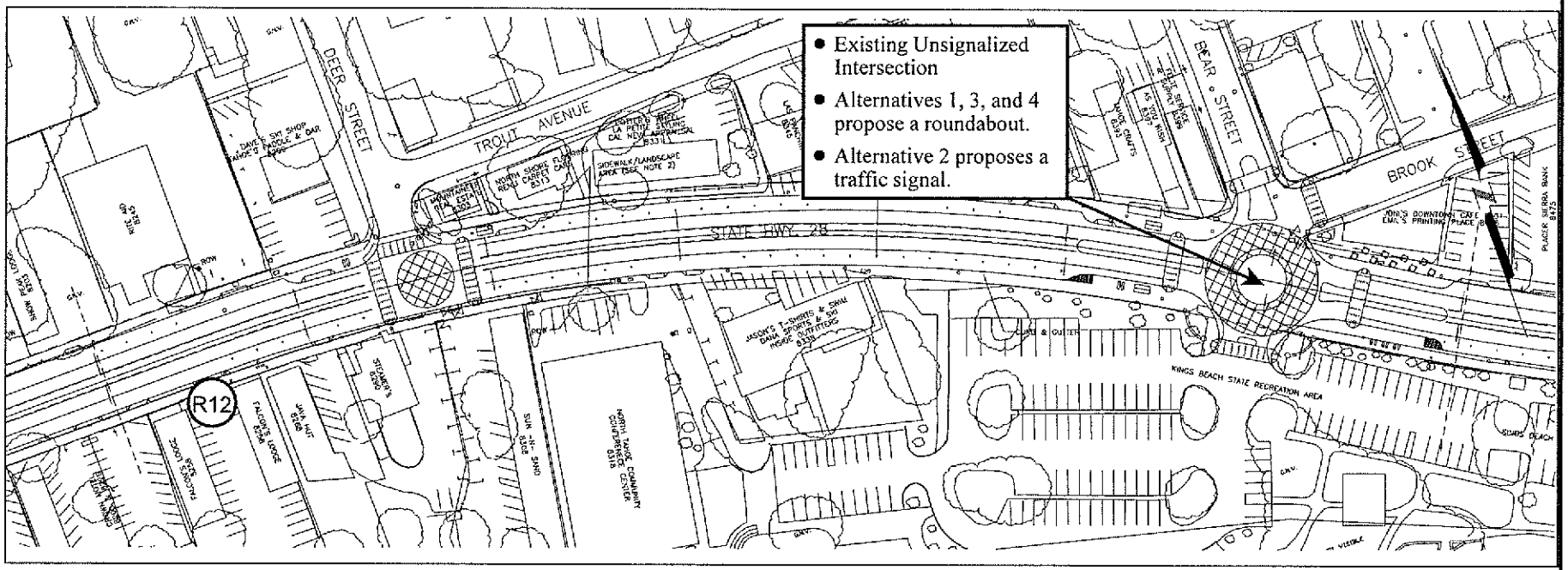
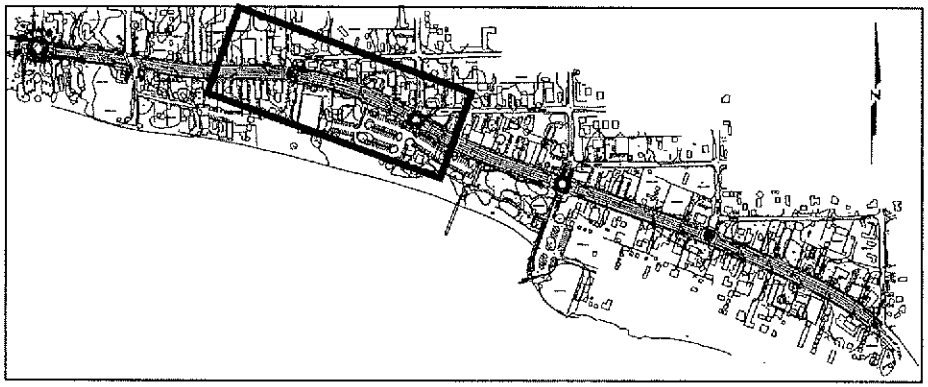
Figure 3.9-2B
Modeled Receiver Locations



Graphic Location:



R# : Modeled Receiver Locations

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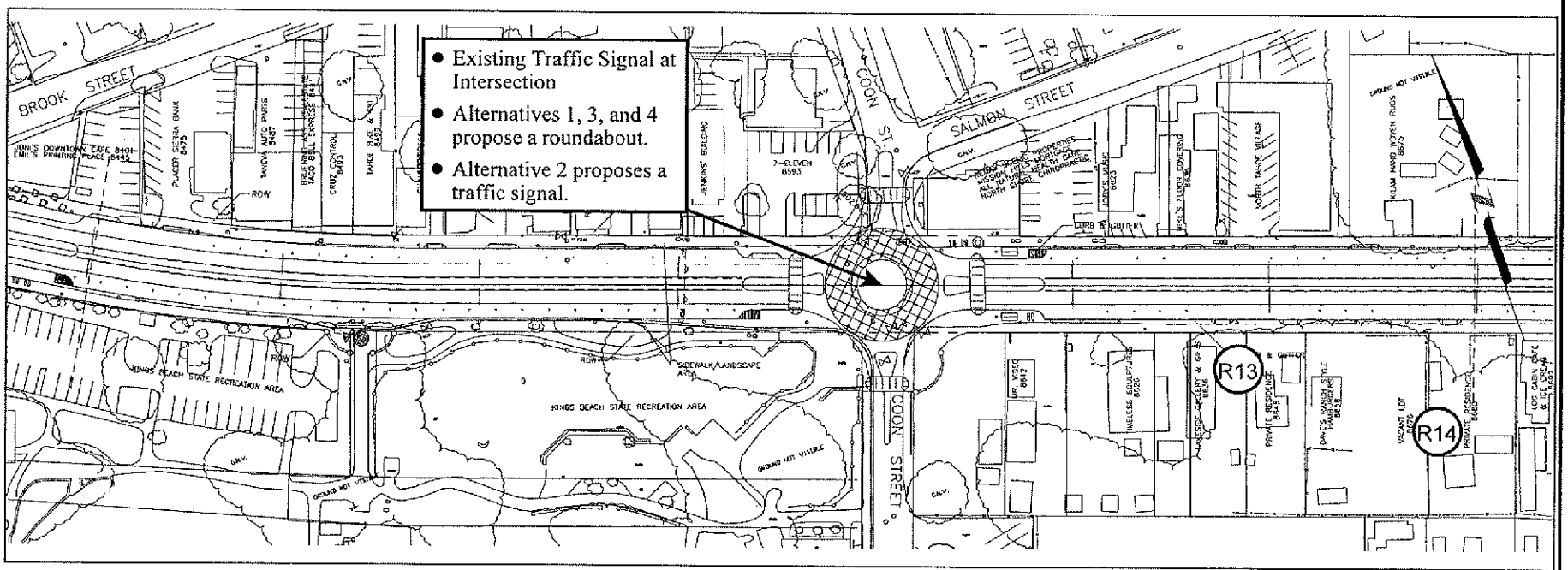
Figure 3.9-2C
Modeled Receiver Locations



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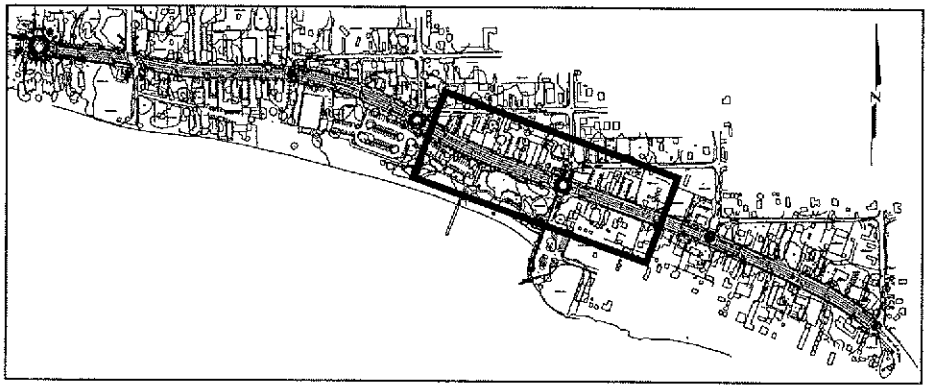

R# : Modeled Receiver Locations

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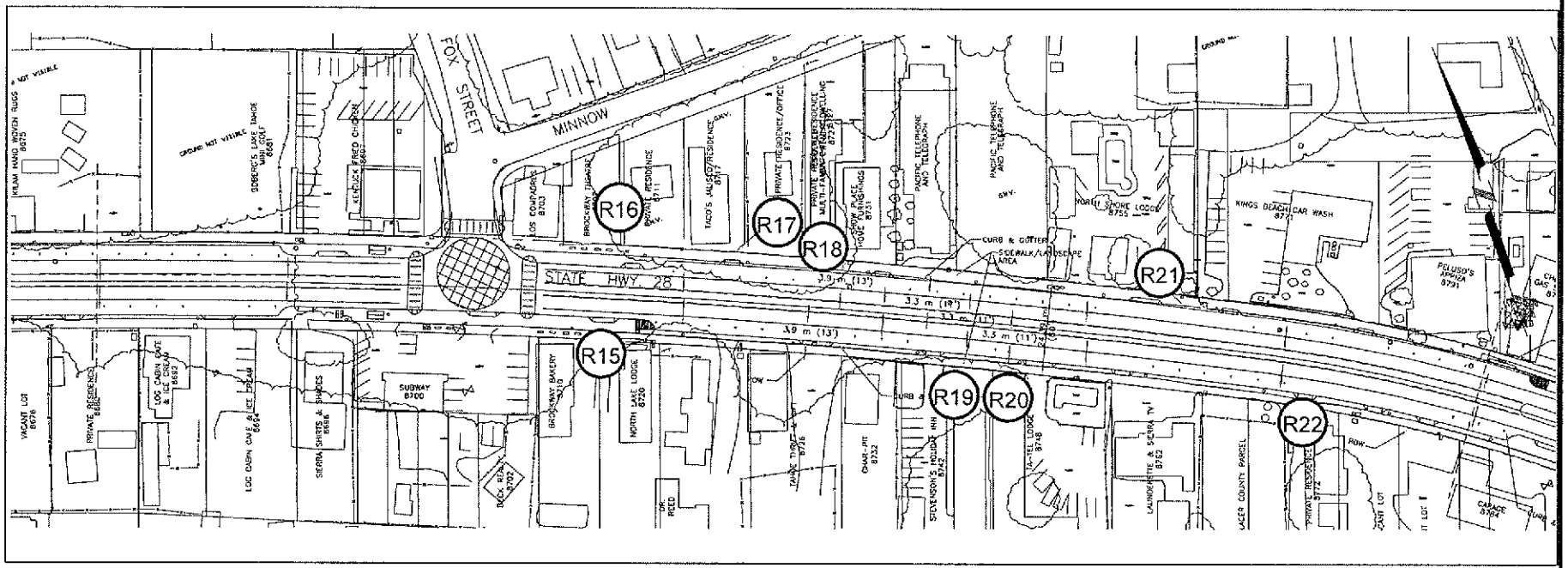
Figure 3.9-2D
Modeled Receiver Locations



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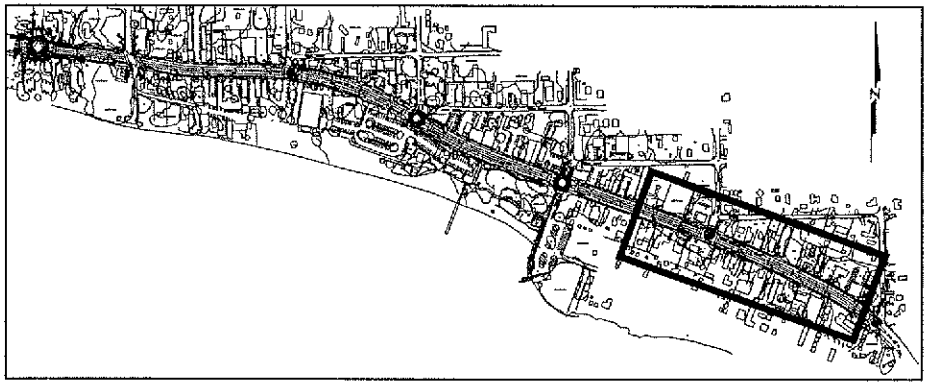

R# : Modeled Receiver Locations

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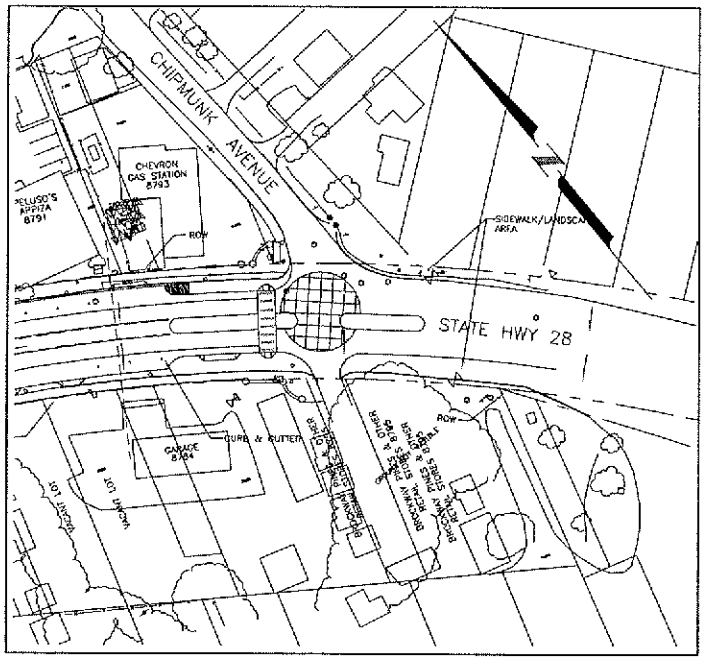
Figure 3.9-2E
Modeled Receiver Locations



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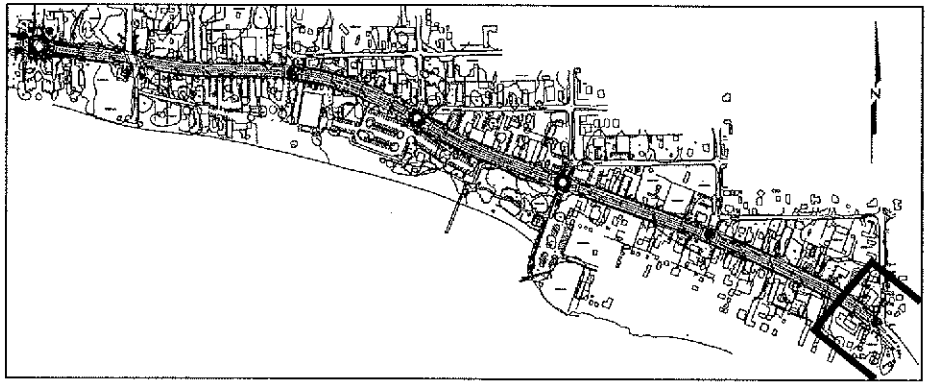

R# : Modeled Receiver Locations

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3.9.2 Affected Environment

3.9.2.1 Existing Noise Environment

Existing measured noise levels ranged from 60dB CNEL to 67dB CNEL, as shown in appendix 3.9-B1 and 3.9-B2.

Noise Sensitive Land Uses in the Vicinity of the Project Site

The land uses adjacent to the project site include mixed land uses, which include residential, motel, church, commercial and light industrial uses.

Figures 3.9-2A through 3.9-2E show the locations of noise-sensitive receivers.

Existing Traffic Noise Levels at Noise Sensitive Receivers

Based upon the results of the Sound-32 Model, Table 3.9-2 shows the existing traffic noise levels at each of the noise-sensitive receivers for the Year 2002. The predicted existing background traffic noise levels at the identified noise-sensitive receivers range between 64 dB and 72 dB Leq. The results indicate that 19 of the 22 noise-sensitive receivers approach or exceed the Caltrans/FHWA NAC criterion of 67 dB Leq.

Table 3.9-2
Summary of Existing (2002) Modeled Traffic Noise Levels
SR 28 Improvements – Kings Beach, CA

Receiver #	Land Use	Summer Conditions Modeled Existing (2002) Design Hour Leq (dBA)
R1	Sweetbriar Condominiums	65
R2	La Camunicad Unida/Little Bear Cottages	**70**
R3	Motel California	**66**
R4	Private Residence	**68**
R5	Caesar's Cottages	**71**
R6	Big 7 Motel	**71**
R7	Multi-Family Residence	65
R8	Annie's Cottages	**71**
R9	Gold Crest Motel	**71**
R10	Snow Peak Lodge	**70**
R11	Crown Motel	**71**
R12	Falcon's Lodge	**72**
R13	Private Residence	**67**
R14	Private Residence	64
R15	North Lake Lodge	**71**
R16	Private Residence	**67**
R17	Private Residence/Office	**66**
R18	Private Residence	**71**
R19	Stevenson's Holiday Inn	**69**
R20	Ta-Tel Lodge	**68**
R21	North Shore Lodge	**70**
R22	Private Residence	**71**

Source: JC Brennan and Associates, Inc. 2005, LSC Transportations Consultants, Inc. 2003
Bold = Approaches or Exceeds Caltrans/FHWA NAC criterion of 67 dB Leq

Based upon the 24-hour continuous noise measurement survey, the predicted CNEL values are expected to be approximately 1 dB less than the predicted Leq values shown in Table 3.9-2. Based upon the predicted noise levels, the 60 dB CNEL traffic noise contour is approximately 280 feet from the roadway centerline, and approximately 240 feet from the roadway edge of pavement. This is consistent with the TRPA Plan Area Statement criterion for S.R. 28 of 60 dB CNEL at a distance of 300 feet from the edge of the roadway pavement.

3.9.2.2 Future Noise Environment,

Future Traffic Data Assumptions and Site Geometry

Future traffic data which was used as direct inputs to the Sound-32 were provided by the project traffic consultant. Speeds along the route were based upon observed travel speeds in the field, and truck mix percentages were based upon Caltrans truck count data for SR 28 and SR 267. Changes in geometry along the project route, based upon proposed improvements to the corridor and interchange were provided by the project traffic consultant. Changes in the geometry are based upon the descriptions for each of the alternatives previously provided in this report.

Predicted Future Traffic Noise Levels, and Identified Traffic Noise Impacts

Once again, the Sound-32 model was employed to evaluate future near-term (year 2008) and future year 2028 traffic noise levels, both with and without the proposed project alternatives.

Table 3.9-3 shows the predicted near term (Year 2008) future traffic noise levels without the project. Table 3.9-4 shows the predicted near term (Year 2008) noise levels with the project alternatives. Table 3.9-5 shows the predicted Year 2028 traffic noise levels without the project. Table 3.9-6 shows the predicted Year 2028 traffic noise levels with the project alternatives.

3.9.2.3 Future Year 2008 No Project

The analysis in Table 3.9-3 indicates that the predicted Future No Project traffic noise levels ranged between 64 dB and 72 dB Leq. Twenty-one of the twenty-two receivers approached or exceeded the Protocol NAC of 67 dB Leq. Only Receiver R14 did not approach or exceed the 67 dB Leq Protocol NAC.

Based upon the analysis, the predicted distance to the 60 dB CNEL contour is 250 feet from the edge of the pavement. This is consistent with the TRPA Plan Area Statement criterion for S.R. 28 of 60 dB CNEL, at a distance of 300 feet from the edge of the roadway pavement.

Table 3.9- 3
Summary of 2008 No Project Modeled Traffic Noise Levels
SR 28 Improvements – Kings Beach, CA

Receiver #	Land Use	Summer Conditions Modeled No Project (2008) Design Hour Leq (dBA)
R1	Sweetbriar Condominiums	**66**
R2	La Camunicad Unida/Little Bear Cottages	**70**
R3	Motel California	**66**
R4	Private Residence	**68**
R5	Caesar's Cottages	**71**
R6	Big 7 Motel	**71**
R7	Multi-Family Residence	**66**
R8	Annie's Cottages	**71**
R9	Gold Crest Motel	**71**
R10	Snow Peak Lodge	**70**
R11	Crown Motel	**71**
R12	Falcon's Lodge	**72**
R13	Private Residence	**67**
R14	Private Residence	64
R15	North Lake Lodge	**71**
R16	Private Residence	**68**
R17	Private Residence/Office	**66**
R18	Private Residence	**71**
R19	Stevenson's Holiday Inn	**69**
R20	Ta-Tel Lodge	**68**
R21	North Shore Lodge	**70**
R22	Private Residence	**71**

Source: JC Brennan and Associates, Inc. 2005, LSC Transportations Consultants, Inc. 2003
Bold = Approaches or Exceeds Caltrans/FHWA NAC criterion of 67 dB Leq

3.9.2.5 Future Year 2028 No Project

The analysis in Table 3.9-4 indicates that the predicted Future Year 2028 No Project traffic noise levels ranged between 66 dB and 74 dB Leq. All of the twenty-two receivers approached or exceeded the Protocol NAC of 67 dB Leq.

Based upon the analysis, the predicted distance to the 60 dB CNEL contour is 300 feet from the edge of the pavement. This is consistent with the TRPA Plan Area Statement criterion for S.R. 28 of 60 dB CNEL, at a distance of 300 feet from the edge of the roadway pavement.

Table 3.9-4
Summary of 2028 No Project Modeled Traffic Noise Levels
SR 28 Improvements – Kings Beach, CA

Receiver #	Land Use	Summer Conditions Modeled No Project (2028) Design Hour Leq (dBA)
R1	Sweetbriar Condominiums	**67**
R2	La Camunicad Unida/Little Bear Cottages	**72**
R3	Motel California	**68**
R4	Private Residence	**70**
R5	Caesar's Cottages	**73**
R6	Big 7 Motel	**73**
R7	Multi-Family Residence	**68**
R8	Annie's Cottages	**73**
R9	Gold Crest Motel	**73**
R10	Snow Peak Lodge	**72**
R11	Crown Motel	**73**
R12	Falcon's Lodge	**74**
R13	Private Residence	**69**
R14	Private Residence	**66**
R15	North Lake Lodge	**73**
R16	Private Residence	**69**
R17	Private Residence/Office	**68**
R18	Private Residence	**73**
R19	Stevenson's Holiday Inn	**71**
R20	Ta-Tel Lodge	**70**
R21	North Shore Lodge	**72**
R22	Private Residence	**73**

Source: JC Brennan and Associates, Inc. 2005, LSC Transportations Consultants, Inc. 2003
Bold = Approaches or Exceeds Caltrans/FHWA NAC criterion of 67 dB Leq

3.9.3 Environmental Consequences/Impacts

3.9.3.1 Future Year 2008 With Project Build Alternatives

The analysis in Table 3.9-5 indicates that the predicted future traffic noise levels ranged between 64 dB and 73 dB Leq. The analysis indicates that 21 of the 22 receivers approach or exceed the Caltrans/FHWA NAC of 67 dB Leq. Only Receiver R14 did not approach or exceed the Caltrans/FHWA NAC of 67 dB Leq.

Based upon the analysis, the predicted distance to the 60 dB CNEL contour is 250 feet from the edge of the pavement. This is consistent with the TRPA Plan Area Statement criterion for S.R. 28 of 60 dB CNEL, at a distance of 300 feet from the edge of the roadway pavement.

The reported noise levels for the Build Alternatives 1, 2 and 3 do not change. The results for the Build Alternative 4 show changes ranging between +1 dB and -1 dB. The noise levels reported in Table 3.9-5 are in whole numbers. In actuality,

the modeling for each of the build alternatives revealed subtle differences in the predicted noise levels. However, they were generally less than 0.5 dB, and were not significant.

Table 3.9-5
Comparison of 2008 Alternatives Modeled Traffic Noise Levels to 2008 No Project Conditions
SR 28 Improvements – Kings Beach, CA

		Summer Conditions Modeled 2008 Design Hour Leq Compared to 2008 No Project Conditions (dBA)							
Receiver #	Land Use	Alt. 1	ΔdB	Alt. 2	ΔdB	Alt. 3	ΔdB	Alt. 4	ΔdB
R1	Sweetbriar Condominiums	**66**	0	**66**	0	**66**	0	**66**	0
R2	La Camunicad Unida/Little Bear Cottages	**70**	0	**70**	0	**70**	0	**69**	-1
R3	Motel California	**66**	0	**66**	0	**66**	0	**67**	1
R4	Private Residence	**68**	0	**68**	0	**68**	0	**69**	1
R5	Caesar's Cottages	**71**	0	**71**	0	**71**	0	**70**	-1
R6	Big 7 Motel	**71**	0	**71**	0	**71**	0	**70**	-1
R7	Multi-Family Residence	**66**	0	**66**	0	**66**	0	**65**	-1
R8	Annie's Cottages	**71**	0	**71**	0	**71**	0	**70**	-1
R9	Gold Crest Motel	**71**	0	**71**	0	**71**	0	**72**	1
R10	Snow Peak Lodge	**70**	0	**70**	0	**70**	0	**69**	-1
R11	Crown Motel	**71**	0	**71**	0	**71**	0	**72**	1
R12	Falcon's Lodge	**72**	0	**72**	0	**72**	0	**73**	1
R13	Private Residence	**67**	0	**67**	0	**67**	0	**68**	1
R14	Private Residence	64	0	64	0	64	0	64	0
R15	North Lake Lodge	**71**	0	**71**	0	**71**	0	**72**	1
R16	Private Residence	**68**	0	**68**	0	**68**	0	**67**	-1
R17	Private Residence/Office	**66**	0	**66**	0	**66**	0	**66**	0
R18	Private Residence	**71**	0	**71**	0	**71**	0	**70**	-1
R19	Stevenson's Holiday Inn	**69**	0	**69**	0	**69**	0	**70**	1
R20	Ta-Tel Lodge	**68**	0	**68**	0	**68**	0	**68**	0
R21	North Shore Lodge	**70**	0	**70**	0	**70**	0	**69**	-1
R22	Private Residence	**71**	0	**71**	0	**71**	0	**72**	1

Source: JC Brennan and Associates, Inc. 2005, LSC Transportations Consultants, Inc. 2003
Bold = Approaches or Exceeds Caltrans/FHWA NAC criterion of 67 dB Leq

3.9.3.2 Future Year 2028 With Project Build Alternatives

The analysis in Table 3.9-6 indicates that the predicted future traffic noise levels ranged between 66 dB and 74 dB Leq. All of the twenty-two receivers approached or exceeded the Protocol NAC of 67 dB Leq.

Based upon the analysis, the predicted distance to the 60 dB CNEL contour is 300 feet from the edge of the pavement. This is consistent with the TRPA Plan Area Statement criterion for S.R. 28 of 60 dB CNEL, at a distance of 300 feet from the edge of the roadway pavement.

The reported noise levels for the Build Alternatives 1, 2 and 3 do not change. The results for the Build Alternative 4 show changes ranging between +1 dB and -1 dB. The noise levels reported in Table 3.9-6 are in whole numbers. In actuality, the modeling for each of the build alternatives revealed subtle differences in the predicted noise levels. However, they were generally less than 0.5 dB, and were not significant.

Table 3.9-6
Comparison of 2028 Modeled Traffic Noise Levels to 2028 No Project Conditions
SR 28 Improvements – Kings Beach, CA

		Summer Conditions Modeled 2028 Design Hour Leq Compared to 2028 No Project Conditions (dBA)							
Receiver #	Land Use	Alt. 1	ΔdB	Alt. 2	ΔdB	Alt. 3	ΔdB	Alt. 4	ΔdB
R1	Sweetbriar Condominiums	**67**	0	**67**	0	**67**	0	**68**	1
R2	La Camunicad Unida/Little Bear Cottages	**72**	0	**72**	0	**72**	0	**71**	-1
R3	Motel California	**68**	0	**68**	0	**68**	0	**68**	1
R4	Private Residence	**70**	0	**70**	0	**70**	0	**71**	1
R5	Caesar's Cottages	**73**	0	**73**	0	**73**	0	**72**	-1
R6	Big 7 Motel	**73**	0	**73**	0	**73**	0	**72**	-1
R7	Multi-Family Residence	**68**	0	**68**	0	**68**	0	**67**	-1
R8	Annie's Cottages	**73**	0	**73**	0	**73**	0	**71**	-1
R9	Gold Crest Motel	**73**	0	**73**	0	**73**	0	**74**	1
R10	Snow Peak Lodge	**72**	0	**72**	0	**72**	0	**71**	-1
R11	Crown Motel	**73**	0	**73**	0	**73**	0	**74**	1
R12	Falcon's Lodge	**74**	0	**74**	0	**74**	0	**74**	0
R13	Private Residence	**69**	0	**69**	0	**69**	0	**70**	1
R14	Private Residence	**66**	0	**66**	0	**66**	0	**66**	0
R15	North Lake Lodge	**73**	0	**73**	0	**73**	0	**74**	1
R16	Private Residence	**69**	0	**69**	0	**69**	0	**69**	-1
R17	Private Residence/Office	**68**	0	**68**	0	**68**	0	**67**	-1
R18	Private Residence	**73**	0	**73**	0	**73**	0	**71**	-1
R19	Stevenson's Holiday Inn	**71**	0	**71**	0	**71**	0	**71**	1
R20	Ta-Tel Lodge	**70**	0	**70**	0	**70**	0	**70**	1
R21	North Shore Lodge	**72**	0	**72**	0	**72**	0	**70**	-1
R22	Private Residence	**73**	0	**73**	0	**73**	0	**74**	1

Source: JC Brennan and Associates, Inc. 2005, LSC Transportations Consultants, Inc. 2003
Bold = Approaches or Exceeds Caltrans/FHWA NAC criterion of 67 dB Leq

3.9.3.3 Construction Noise

During the construction phases of the project, noise from construction activities would dominate the noise environment in the immediate area. Activities involved in construction would generate noise levels, as indicated in Table 3.9-7, ranging from 70 to 90 dB at a distance of 50 feet. Construction activities would be temporary in nature, typically occurring during normal working hours. Construction noise impacts could be significant, as nighttime operations or use of

unusually noisy equipment could result in annoyance or sleep disruption for nearby residences. The project anticipates that some nighttime construction could occur.

Construction noise is regulated by Caltrans standard specifications Section 7-1.01I "Sound Control Requirements". These requirements state that noise levels generated during construction shall comply with applicable local, state, and federal regulations, and that all equipment shall be fitted with adequate mufflers according to the manufacturer's specifications.

The TRPA Code of Ordinances, Chapter 23 Noise Limitations provides exemptions from noise regulations. Section 23.8 Exemptions to Noise Limits, states the following:

The standards of this chapter shall not apply to noise from TRPA-approved construction or maintenance projects, or the demolition of structures, provided such activities are limited to the hours of 8 a.m. and 6:30 p.m.

During construction, traffic noise generated by approaching traffic would be reduced due to a reduction in speed required by working road crews. Conversely, traffic noise levels of vehicles leaving the construction area would be slightly higher than normal due to acceleration. The net effect of the accelerating and decelerating traffic upon noise would not be appreciable. The most important project-generated noise source would be truck traffic associated with transport of heavy materials and equipment and construction equipment.

It is expected that the construction noise during the nighttime periods could result in a significant noise impact. It is recommended that pneumatic tools and demolition equipment operations are limited to the daytime hours. It is also recommended that residents are notified in advance of nighttime construction activities. To the extent possible, the nighttime construction work should be limited to the portion of the project site furthest from the residences.

Table 3.9-7
Construction Equipment Noise

Type of Equipment	Maximum Level, dBA at 50 feet
Scrapers	88
Bulldozers	87
Heavy Trucks	88
Backhoe	85
Pneumatic Tools	85

Source: Environmental Noise Pollution, Patrick R. Cunniff, 1977.

3.9.4 Mitigation

Any noise problem may be considered as being composed of three basic elements: the noise source, a transmission path, and a receiver. The appropriate acoustical treatment for a given project should consider the nature of the noise source and the sensitivity of the receiver. Noise control techniques should be selected to provide an acceptable noise environment for the receiving property while remaining consistent with local aesthetic standards and practical structural and economic limits.

Shielding by barriers can be obtained by placing walls or berms between the noise source and the receiver. The effectiveness of a barrier depends upon blocking line-of-sight between the source and receiver, and is improved with increases in distance the sound must travel to pass over the barrier as compared to a straight line from source to receiver. The difference between the distance over a barrier and a straight line between source and receiver is called the "path length difference," and is the basis for calculating barrier noise reduction.

Barrier effectiveness depends upon the relative heights of the source, barrier and receiver. In general, barriers are most effective when placed close to either the receiver or the source. An intermediate barrier location yields a smaller path length difference for a given increase in barrier height than does a location closer to either source or receiver. In addition, barriers are generally rendered ineffective when there are openings or gaps, or when they are not of sufficient length to prevent sound from flanking around the ends of the barriers.

Other types of mitigation measures may include limiting truck traffic, reducing speeds and use of alternative pavements. Each of these alternative means of reducing traffic noise levels provide varying results based upon overall truck mix, existing speeds and existing pavement conditions.

The Protocol provides guidance in determining Noise Abatement Feasibility and Reasonableness. The Protocol states that:

Protocol Feasibility Discussion: *Feasibility is defined as an engineering consideration. A minimum of 5 dBA noise reduction must be achieved at the impacted receivers in order for the proposed noise abatement measure to be considered feasible. The feasibility criterion is not necessarily a noise abatement deisgn goal. Greater noise reductions are encouraged if they can be reasonably achieved. Feasibility may be restricted by: (1) topography; (2) access requirements for driveways, ramps, etc.; (3) the presence of local cross streets, (4) other noise sources in the area, and (5) safety considerations.*

Protocol Noise Abatement Reasonableness Discussion: *The determination of reasonableness of noise abatement is more subjective than the determination of its feasibility. It implies that common sense and good judgment have been applied*

in arriving at a decision. There will be instances where noise abatement may be found feasible even though it is outside the established bounds of reasonableness. The individual circumstances of each project and consideration of borderline cases should be part of the overall decision making process.

The overall reasonableness of noise abatement is determined by considering a multitude of factors including but not necessarily limited to the following:

a. Cost of the abatement;
b. Absolute noise levels;
c. Change in noise levels;
d. Noise abatement benefits;
e. Date of development along the highway;
f. Life cycle of abatement measures;
g. Environmental impacts of abatement construction;
h. Views (opinions) of impacted residents;
i. Input from the public and local agencies;
j. Social, economic, environmental, legal, and technological factors.

Use of Barriers for Mitigation

In the case of the SR 28 project, the project roadway corridor can be characterized as having numerous driveway accesses to SR 28. These driveway access points would prevent the construction of barriers, due to significant gaps in the barriers. The gap or opening in a sound wall would compromise the barrier effectiveness. In addition, due to the aesthetic effects of constructing barriers along the SR 28 corridor, the TRPA is not likely to approve barrier construction.

It is determined that a barrier would not be feasible or reasonable.

Restriction of Truck Traffic

Due to the small number of heavy trucks along S.R. 28, restricting truck traffic along SR 28 is not considered a means of achieving a minimum 5 dB reduction in traffic noise. Therefore, it is not considered a feasible or reasonable means of reducing traffic noise levels.

Reducing Travel Speeds

It is likely that reducing travel speeds could provide for some improvement in overall traffic noise levels. In some cases, a 5 mile reduction in travel speeds can yield a 2 to 3 dB reduction in overall noise levels. However, travel speeds are set based upon standard traffic engineering practices, and this may not be feasible. In the case of the predicted traffic noise levels in this report, the Sound 2000 model, which is used by Caltrans, will not allow modeling of traffic noise levels for

speeds less than 30 miles per hour, which is the existing posted speed limit in the corridor.

Use of Alternative Pavements

Other mitigation measures can include the use of rubberized asphalt or open-gap asphalt. FHWA does not currently recognize alternative pavement types as a noise mitigation/abatement option. The following discussion of rubberized asphalt/open-gap asphalt is intended as a CEQA measure only.

Studies conducted for the Sacramento County Department of Environmental Review and Assessment and Transportation Department to determine the noise reduction provided by rubberized asphalt have been completed in recent years. Those studies indicate that the use of rubberized asphalt on Sacramento County roadways appears to have resulted in an average traffic noise level reduction of approximately 4 dBA to 5 dBA over that provided by conventional asphalt. The European Commission Green Paper, published in the June 1997 edition of Noise/News International, cites the following on Page 87:

"Low-noise porous road surfaces have been the subject of much research. These porous road surfaces reduce both the generation and propagation of noise by several mechanisms - which can be related to the open structure of the surface layer. Results have shown that the emission noise levels can be reduced from levels generated on equivalent non-porous road surfaces by between 3-5 dB(A) on average; by optimizing the surface design, larger noise reductions are feasible. At present, the cost of porous asphalt surfacing is higher than conventional surfaces (for resurfacing, but for new roads, the cost is minimal), but may drop as contractors gain experience with porous surfaces."

The use of noise-reducing paving materials along the project site appears to be a feasible means of achieving a 4 dBA to 5 dBA decrease in traffic noise and reducing the potential for adverse public reaction to future traffic noise levels along the roadway.

This may be considered a reasonable means of reducing traffic noise levels along the corridor.

Time of Day Restrictions on Construction

Construction Activities shall be limited to between the hours of 8 a.m. and 6:30 p.m.

I. References

1. **2003 Traffic Volumes on the California State Highway System**, Business, Transportation and Housing Agency, Department of Transportation, Division of Traffic Operation, State of California, June 2003.

2. **Sound 32 (Caltrans Version of Stamina2/Optima**, Office of Transportation Laboratory, California, Department of Transportation, Sacramento, California, July 1991.

3. **R.W. Hendriks, California Vehicle Noise Emissions Levels**, FHWA/CA/TL-87/03, Office of Transportation Laboratory, California, Department of Transportation, Sacramento, California, January 1987.

4. **Kings Beach Commercial Core Traffic Study**, LSC Transportaion Consultants, Inc., November 2003.

5. **Traffic Noise Analysis Protocol For New Highway and Reconstruction Projects**, California Department of Transportation, Environmental Program, Environmental Engineering, October 1998.

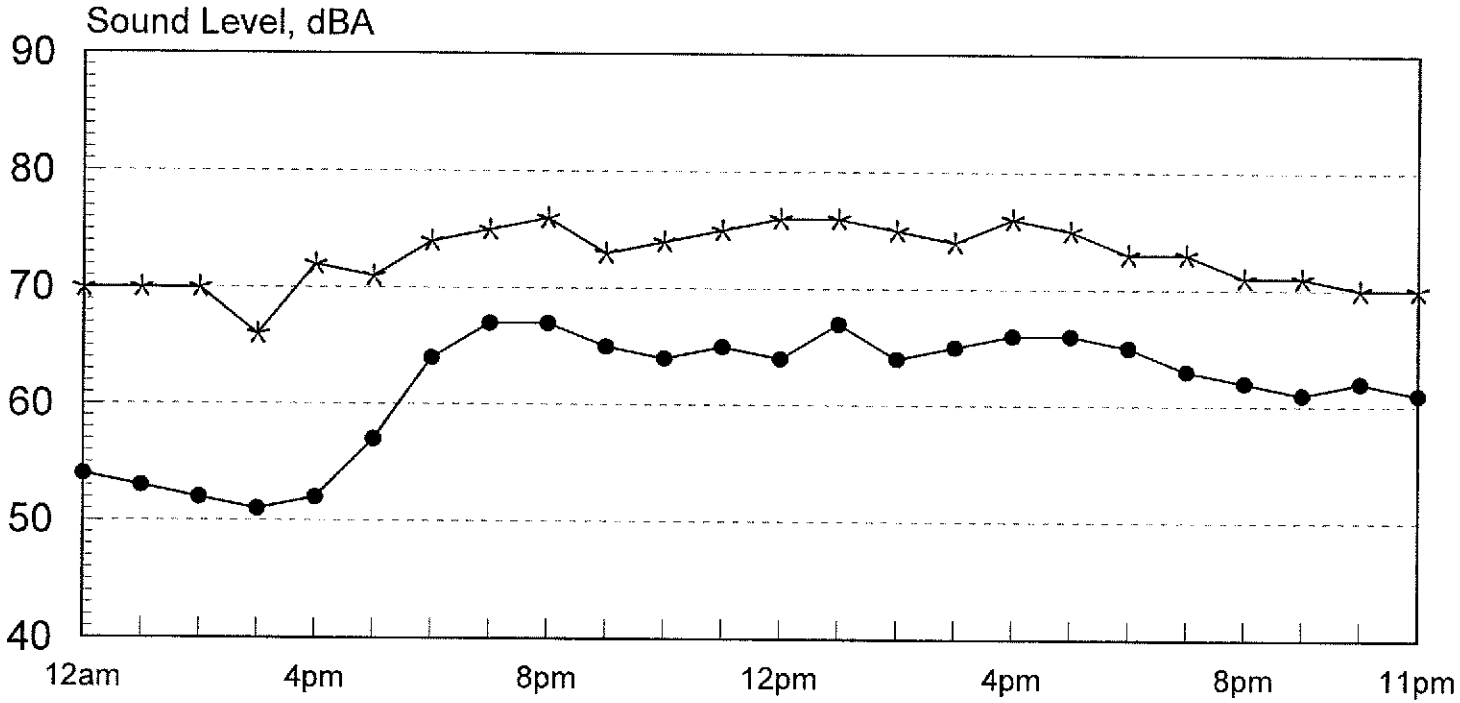
6. **Technical Noise Supplement TENS,** A Technical Supplement to the Traffic Noise Analysis Protocol, California Department of Transportation, Environmental Program, Environmental Engineering, October 1998.

Appendix A

Acoustical Terminology

Acoustics	The science of sound.
Ambient Noise	The distinctive acoustical characteristics of a given space consisting of all noise sources audible at that location. In many cases, the term ambient is used to describe an existing or pre-project condition such as the setting in an environmental noise study.
Attenuation	The reduction of an acoustic signal.
A-Weighting	A frequency-response adjustment of a sound level meter that conditions the output signal to approximate human response.
Decibel or dB	Fundamental unit of sound, A Bell is defined as the logarithm of the ratio of the sound pressure squared over the reference pressure squared. A Decibel is one-tenth of a Bell.
CNEL	Community Noise Equivalent Level. Defined as the 24-hour average noise level with noise occurring during evening hours (7 - 10 p.m.) weighted by a factor of three and nighttime hours weighted by a factor of 10 prior to averaging.
Frequency	The measure of the rapidity of alterations of a periodic signal, expressed in cycles per second or hertz.
Ldn	Day/Night Average Sound Level. Similar to CNEL but with no evening weighting.
Leq	Equivalent or energy-averaged sound level.
Lmax	The highest root-mean-square (RMS) sound level measured over a given period of time.
L(n)	The sound level exceeded a described percentile over a measurement period. For instance, an hourly L50 is the sound level exceeded 50% of the time during the one hour period.
Loudness	A subjective term for the sensation of the magnitude of sound.
Noise	Unwanted sound.
Peak Noise	The level corresponding to the highest (not RMS) sound pressure measured over a given period of time. This term is often confused with the "Maximum" level, which is the highest RMS level.
RT_{60}	The time it takes reverberant sound to decay by 60 dB once the source has been removed.
Sabin	The unit of sound absorption. One square foot of material absorbing 100% of incident sound has an absorption of 1 sabin.
Threshold of Hearing	The lowest sound that can be perceived by the human auditory system, generally considered to be 0 dB for persons with perfect hearing.
Threshold of Pain	Approximately 120 dB above the threshold of hearing.
Impulsive	Sound of short duration, usually less than one second, with an abrupt onset and rapid decay.
Simple Tone	Any sound which can be judged as audible as a single pitch or set of single pitches.

Appendix 3.9-B1
Continuous 24-hour Noise Measurements
Site 1 - @ 75 feet from S.R. 28 Roadway Centerline
August 27, 2004

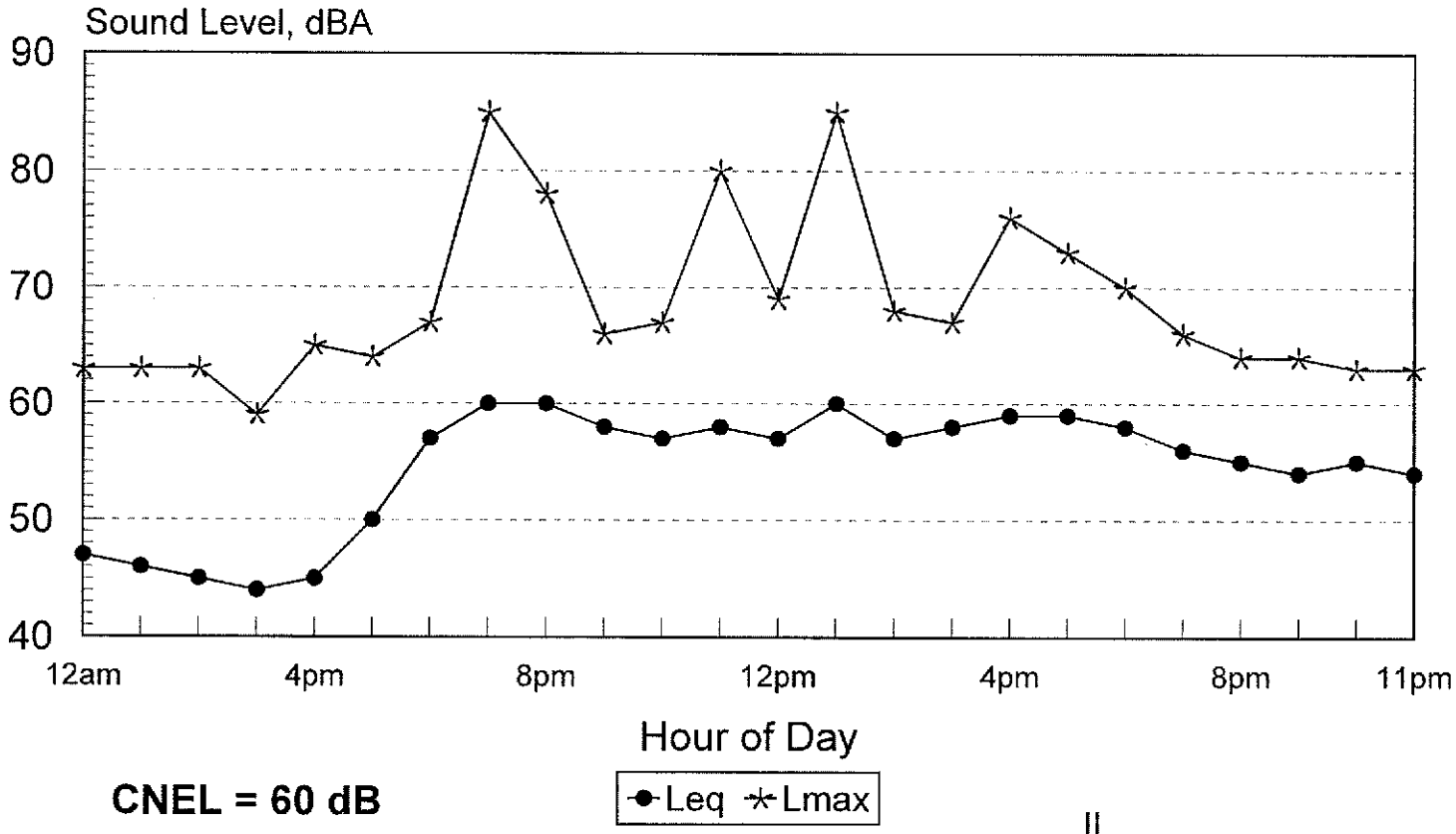


CNEL = 67 dB

j.c. brennan & associates
consultants in acoustics

Appendix B1

Continuous 24-hour Noise Measurements
Site 2 - @ 200 feet from S.R. 28 Roadway Centerline
October 8, 2004



CNEL = 60 dB

j.c. brennan & associates
consultants in acoustics

SOUND32 - RELEASE 07/30/91, MODIFIED 04/22/00

TITLE:
2004-321 SR 28 IMPROVEMENTS - NO PROJECT - SUMMER 2002

BASED ON FHWA-RD-108 AND
CALIFORNIA REFERENCE ENERGY MEAN EMISSION LEVELS

RECEIVER	LEQ
R1	65.4
R2	69.7
R3	65.9
R4	67.9
R5	71.3
R6	71.1
R7	65.5
R8	70.6
R9	71.1
R10	70.1
R11	71.0
R12	72.3
R13	67.4
R14	63.6
R15	70.8
R16	67.4
R17	66.2
R18	70.9
R19	68.6
R20	67.6
R21	69.6
R22	70.8

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TITLE:
2004-321 SR 28 IMPROVEMENTS - NO PROJECT - SUMMER 2008

BASED ON FHWA-RD-108 AND
CALIFORNIA REFERENCE ENERGY MEAN EMISSION LEVELS

RECEIVER	LEQ
R1	65.5
R2	69.8
R3	66.0
R4	68.1
R5	71.4
R6	71.2
R7	65.7
R8	70.7
R9	71.3
R10	70.2
R11	71.1
R12	72.4
R13	67.4
R14	63.7
R15	70.9
R16	67.5
R17	66.2
R18	70.9
R19	68.7
R20	67.7
R21	69.7
R22	70.9

2004-321 Sound32 - NO PROJECT - SUMMER 2028
SOUND32 - RELEASE 07/30/91, MODIFIED 04/22/00

TITLE:
2004-321 SR 28 IMPROVEMENTS - NO PROJECT - SUMMER 2028

BASED ON FHWA-RD-108 AND
CALIFORNIA REFERENCE ENERGY MEAN EMISSION LEVELS

RECEIVER	LEQ
R1	67.4
R2	71.7
R3	67.9
R4	69.9
R5	73.2
R6	73.1
R7	67.5
R8	72.6
R9	73.1
R10	72.1
R11	73.0
R12	74.3
R13	69.3
R14	65.6
R15	72.8
R16	69.4
R17	68.1
R18	72.8
R19	70.6
R20	69.6
R21	71.6
R22	72.8

2004-321 Sound32 - ALTERNATIVE 1 - SUMMER 2002
SOUND32 - RELEASE 07/30/91, MODIFIED 04/22/00

TITLE:
2004-321 SR 28 IMPROVEMENTS - ALTERNATIVE 1 - SUMMER 2002

BASED ON FHWA-RD-108 AND
CALIFORNIA REFERENCE ENERGY MEAN EMISSION LEVELS

RECEIVER	LEQ
R1	65.5
R2	69.7
R3	65.9
R4	68.0
R5	71.3
R6	71.1
R7	65.5
R8	70.6
R9	71.1
R10	70.1
R11	71.0
R12	72.3
R13	67.4
R14	63.6
R15	70.8
R16	67.4
R17	66.2
R18	70.9
R19	68.6
R20	67.6
R21	69.6
R22	70.8

SOUND32 - RELEASE 07/30/91, MODIFIED 04/22/00

TITLE:
2004-321 SR 28 IMPROVEMENTS - ALTERNATIVE 1 - SUMMER 2008

BASED ON FHWA-RD-108 AND
CALIFORNIA REFERENCE ENERGY MEAN EMISSION LEVELS

RECEIVER	LEQ
SWEETBRI	65.6
LA CAMUN	69.8
MOTEL CA	66.0
PRIVATE	68.1
CAESAR'S	71.4
BIG 7 MO	71.2
MULTI-FA	65.7
ANNIE'S	70.7
GOLD CRE	71.3
SNOW PEA	70.2
CROWN MO	71.1
FALCON'S	72.4
PRIVATE	67.4
PRIVATE	63.7
NORTH LA	70.9
PRIVATE	67.5
PRIVATE	66.2
PRIVATE	70.9
STEVENSO	68.7
TA-TEL L	67.7
NORTH SH	69.7
PRIVATE	70.9

2004-321 Sound32 - ALTERNATIVE 1 - SUMMER 2028
SOUND32 - RELEASE 07/30/91, MODIFIED 04/22/00

TITLE:
2004-321 SR 28 IMPROVEMENTS - ALTERNATIVE 1 - SUMMER 2028

BASED ON FHWA-RD-108 AND
CALIFORNIA REFERENCE ENERGY MEAN EMISSION LEVELS

RECEIVER	LEQ
SWEETBRI	67.4
LA CAMUN	71.7
MOTEL CA	67.9
PRIVATE	69.9
CAESAR'S	73.2
BIG 7 MO	73.1
MULTI-FA	67.5
ANNIE'S	72.6
GOLD CRE	73.1
SNOW PEA	72.1
CROWN MO	73.0
FALCON'S	74.3
PRIVATE	69.3
PRIVATE	65.6
NORTH LA	72.8
PRIVATE	69.4
PRIVATE	68.1
PRIVATE	72.8
STEVENSO	70.6
TA-TEL L	69.6
NORTH SH	71.6
PRIVATE	72.8

SOUND32 - RELEASE 07/30/91, MODIFIED 04/22/00

TITLE:
2004-321 SR 28 IMPROVEMENTS - ALTERNATIVE 2 - SUMMER 2002

BASED ON FHWA-RD-108 AND
CALIFORNIA REFERENCE ENERGY MEAN EMISSION LEVELS

RECEIVER	LEQ
R1	65.4
R2	69.7
R3	65.9
R4	67.9
R5	71.3
R6	71.1
R7	65.5
R8	70.6
R9	71.1
R10	70.1
R11	71.0
R12	72.3
R13	67.4
R14	63.6
R15	70.8
R16	67.4
R17	66.2
R18	70.9
R19	68.6
R20	67.6
R21	69.6
R22	70.8

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TITLE:
2004-321 SR 28 IMPROVEMENTS - ALTERNATIVE 2 - SUMMER 2008

BASED ON FHWA-RD-108 AND
CALIFORNIA REFERENCE ENERGY MEAN EMISSION LEVELS

RECEIVER	LEQ
R1	65.5
R2	69.8
R3	66.0
R4	68.1
R5	71.4
R6	71.2
R7	65.7
R8	70.7
R9	71.3
R10	70.2
R11	71.1
R12	72.4
R13	67.4
R14	63.7
R15	70.9
R16	67.5
R17	66.2
R18	70.9
R19	68.7
R20	67.7
R21	69.7
R22	70.9

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TITLE:
2004-321 SR 28 IMPROVEMENTS - ALTERNATIVE 2 - SUMMER 2028

BASED ON FHWA-RD-108 AND
CALIFORNIA REFERENCE ENERGY MEAN EMISSION LEVELS

RECEIVER	LEQ
R1	67.4
R2	71.7
R3	67.9
R4	69.9
R5	73.2
R6	73.1
R7	67.5
R8	72.6
R9	73.1
R10	72.1
R11	73.0
R12	74.3
R13	69.3
R14	65.6
R15	72.8
R16	69.4
R17	68.1
R18	72.8
R19	70.6
R20	69.6
R21	71.6
R22	72.8

2004-321 Sound32 - ALTERNATIVE 3 - SUMMER 2002
SOUND32 - RELEASE 07/30/91, MODIFIED 04/22/00

TITLE:
2004-321 SR 28 IMPROVEMENTS - ALTERNATIVE 3 - SUMMER 2002

BASED ON FHWA-RD-108 AND
CALIFORNIA REFERENCE ENERGY MEAN EMISSION LEVELS

RECEIVER	LEQ
R1	65.5
R2	69.7
R3	65.9
R4	68.0
R5	71.3
R6	71.1
R7	65.5
R8	70.6
R9	71.1
R10	70.1
R11	71.0
R12	72.3
R13	67.4
R14	63.6
R15	70.8
R16	67.4
R17	66.2
R18	70.9
R19	68.6
R20	67.6
R21	69.6
R22	70.8

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TITLE:
2004-321 SR 28 IMPROVEMENTS - ALTERNATIVE 3 - SUMMER 2008

BASED ON FHWA-RD-108 AND
CALIFORNIA REFERENCE ENERGY MEAN EMISSION LEVELS

RECEIVER	LEQ
R1	65.6
R2	69.8
R3	66.0
R4	68.1
R5	71.4
R6	71.2
R7	65.7
R8	70.7
R9	71.3
R10	70.2
R11	71.1
R12	72.4
R13	67.4
R14	63.7
R15	70.9
R16	67.5
R17	66.2
R18	70.9
R19	68.7
R20	67.7
R21	69.7
R22	70.9

2004-321 Sound32 - ALTERNATIVE 3 - SUMMER 2028
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TITLE:
2004-321 SR 28 IMPROVEMENTS - ALTERNATIVE 3 - SUMMER 2028

BASED ON FHWA-RD-108 AND
CALIFORNIA REFERENCE ENERGY MEAN EMISSION LEVELS

RECEIVER	LEQ
R1	67.4
R2	71.7
R3	67.9
R4	69.9
R5	73.2
R6	73.1
R7	67.5
R8	72.6
R9	73.1
R10	72.1
R11	73.0
R12	74.3
R13	69.3
R14	65.6
R15	72.8
R16	69.4
R17	68.1
R18	72.8
R19	70.6
R20	69.6
R21	71.6
R22	72.8

2004-321 Sound32 - ALTERNATIVE 4 - SUMMER 2002
SOUND32 - RELEASE 07/30/91, MODIFIED 04/22/00

TITLE:
2004-321 SR 28 IMPROVEMENTS - ALTERNATIVE 4 - SUMMER 2002

BASED ON FHWA-RD-108 AND
CALIFORNIA REFERENCE ENERGY MEAN EMISSION LEVELS

RECEIVER	LEQ
R1	65.9
R2	68.5
R3	66.4
R4	68.7
R5	69.9
R6	69.8
R7	65.0
R8	69.3
R9	72.0
R10	68.9
R11	71.8
R12	73.3
R13	68.0
R14	64.0
R15	71.8
R16	66.5
R17	65.5
R18	69.5
R19	69.4
R20	68.3
R21	68.3
R22	71.7

2004-321 Sound32 - ALTERNATIVE 4 - SUMMER 2008
SOUND32 - RELEASE 07/30/91, MODIFIED 04/22/00

TITLE:
2004-321 SR 28 IMPROVEMENTS - ALTERNATIVE 4 - SUMMER 2008

BASED ON FHWA-RD-108 AND
CALIFORNIA REFERENCE ENERGY MEAN EMISSION LEVELS

RECEIVER	LEQ
R1	66.1
R2	68.6
R3	66.5
R4	68.8
R5	70.0
R6	69.9
R7	65.1
R8	69.5
R9	72.1
R10	69.0
R11	71.9
R12	73.4
R13	68.1
R14	64.1
R15	71.8
R16	66.6
R17	65.5
R18	69.5
R19	69.5
R20	68.4
R21	68.4
R22	71.8

SOUND32 - RELEASE 07/30/91, MODIFIED 04/22/00

TITLE:
2004-321 SR 28 IMPROVEMENTS - ALTERNATIVE 4 - SUMMER 2028

BASED ON FHWA-RD-108 AND
CALIFORNIA REFERENCE ENERGY MEAN EMISSION LEVELS

RECEIVER	LEQ
R1	67.9
R2	70.5
R3	68.4
R4	70.7
R5	71.9
R6	71.8
R7	67.0
R8	71.3
R9	74.0
R10	70.9
R11	73.7
R12	75.3
R13	70.0
R14	66.0
R15	73.7
R16	68.5
R17	67.4
R18	71.4
R19	71.4
R20	70.3
R21	70.3
R22	73.7